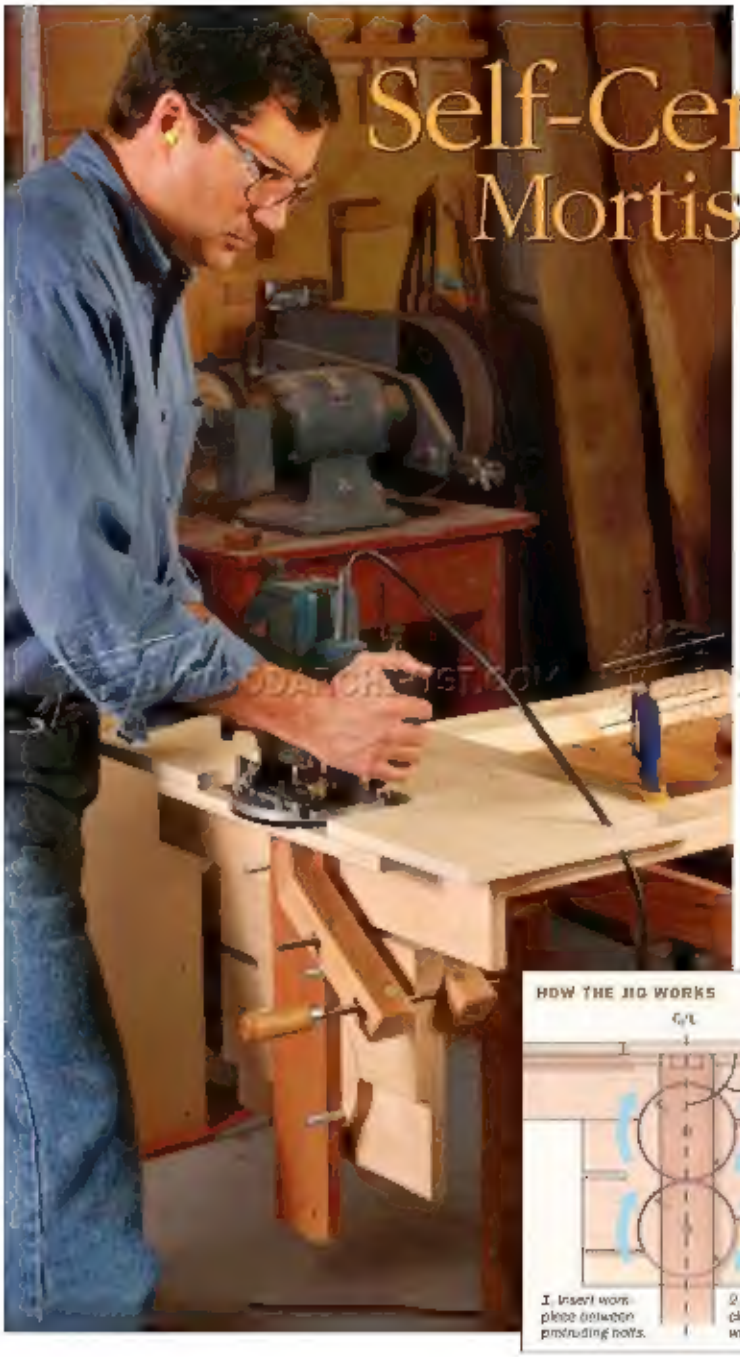


Self-Centering Mortising Jig

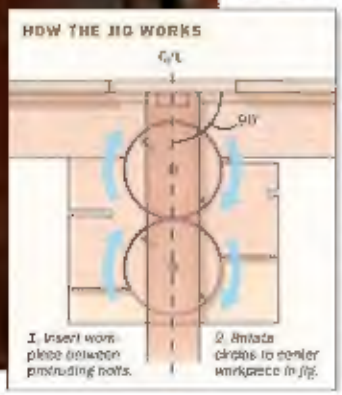
Rotating circles make on-the-mark mortises every time

BY DAVID LEMMAN

Recently, as I considered a set of bedroom furniture I was designing, I counted more than 50 mortise-and-tenon joints. I needed a way to make them as simply, precisely, and consistently as possible. To me, that meant using loose tenons; it's much easier than with standard tenons. There are no shoulders to cut (and then fine-tune) for a perfect fit. There's no need to add tenon length to suit length just cut to suit shoulder-to-shoulder dimensions. And it's easier to cut tenons separately than at the ends of rails.

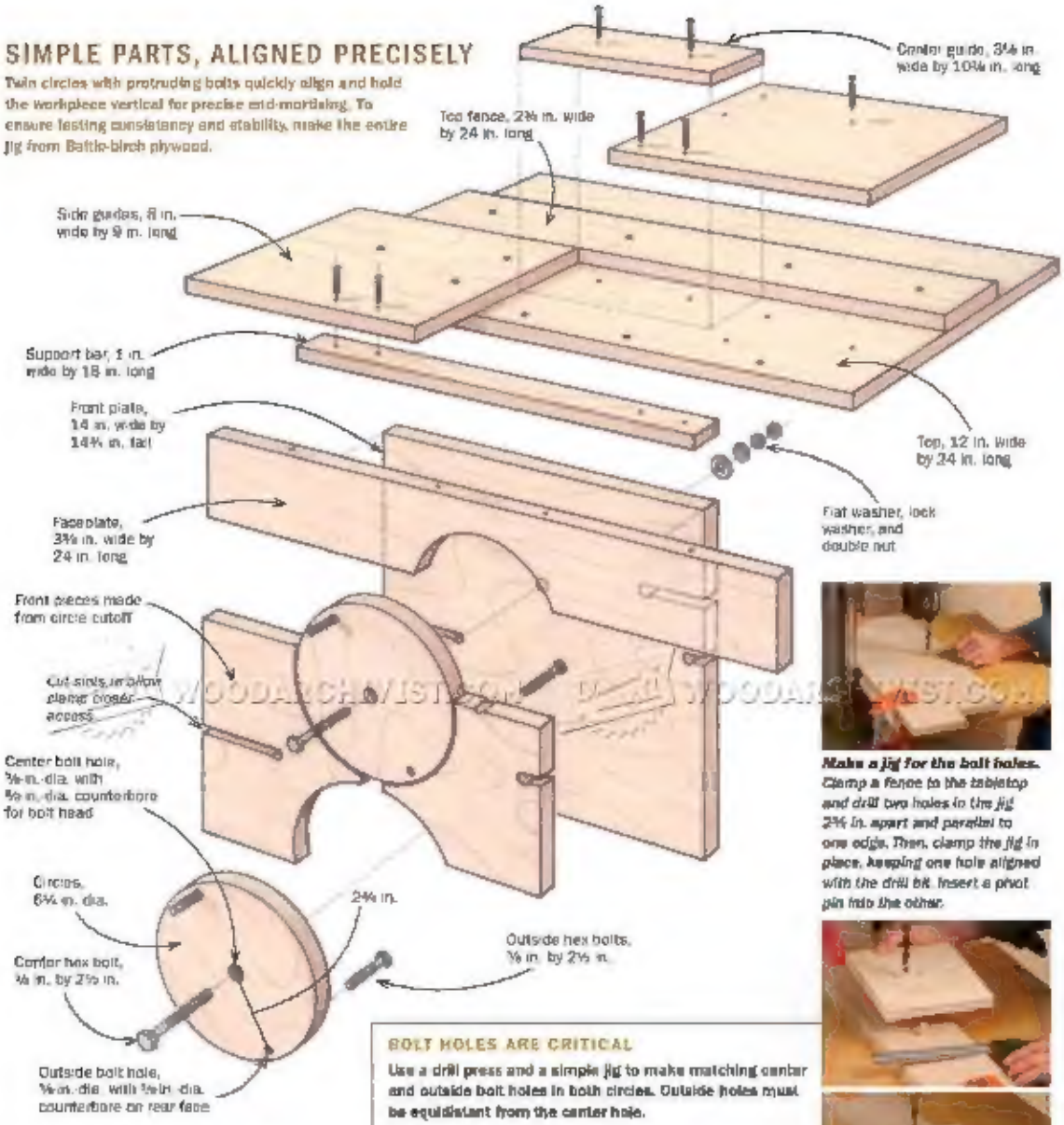
All it takes is two perfectly matching mortises in mating pieces. And I decided a shopmade jig would do that job best.

My jig uses two vertically aligned, rotating circles with protruding metal bolts to center the rails automatically for end mortising. The



SIMPLE PARTS, ALIGNED PRECISELY

Twin circles with protruding bolts quickly align and hold the workpiece vertical for precise end-mortising. To ensure lasting consistency and stability, make the entire jig from Baltic-birch plywood.



Make a jig for the bolt holes. *Clamp a fence to the tabletop and drill two holes in the jig 2¾ in. apart and parallel to one edge. Then, clamp the jig in place, keeping one hole aligned with the drill bit. Insert a pivot pin into the other.*

Drill the holes. *Place the blank's center hole over the pivot pin, using a square to align the edge. Drill the first hole, then rotate the blank 180°.*

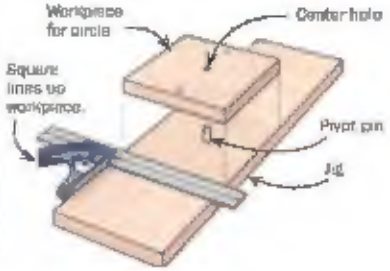
jig, made of Baltic-birch plywood, also aligns the stiles horizontally for matching mortises using a simple stop-block setup. And it's semi-dedicated—made to cut the widest mortise I'd need while allowing me to make narrower, and even offset, cuts.

Start with the circles

The jig is centered on the circles, so begin by making them. They must be large

BOLT HOLES ARE CRITICAL

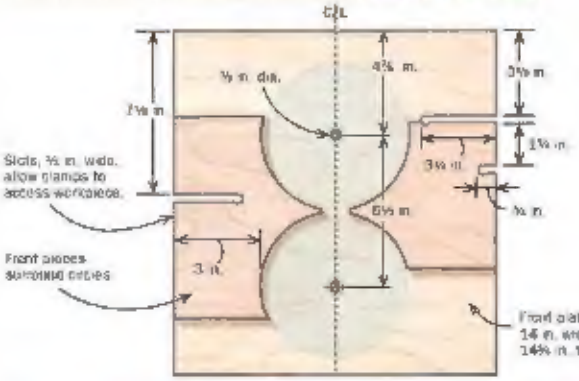
Use a drill press and a simple jig to make matching center and outside bolt holes in both circles. Outside holes must be equidistant from the center hole.



Building the jig

ASSEMBLE THE FRONT

The jig front is critical. The center holes of the circles must be aligned precisely on a centerline perpendicular to the top edge of the front plate. Use a drill press to make sure the holes are true. Slots are machined from the sides to hold the clamps.



Locate the circles on the front plate. *Drill two ¾-in. holes on the centerline for the circles' center holes. Use a fence to ensure that the holes are aligned.*

Attach the circles. *With outside bolts in place, secure the circles to the front plate with ¼-in. bolts through the center holes. Hand-tighten double nuts over the washers and lock the washers.*

Attach the top faceplate. *Align its top edge with that of the front plate. Clamp it in place, and attach with screws from the rear.*

Test for vertical alignment. *Square the end of a test piece and place it between the outside bolts, rotating the circles for a snug fit. The top edge of the test piece should align perfectly with the top edge of the jig. If it doesn't, you can mark and trim the top edge.*

enough to accept the widest piece to be end-mortised between the bolts that protrude from them. My circles are a bit over four dia. and can anform to date at board up to 5in. wide between the bolts.

To make each circle, start by cutting a perfectly square blank slightly larger than the circle it will become.

Mark the center point of the square. Install a ⅜-in.-dia. Forstner bit in your drill press chuck and make a counterbore as deep as the bolt head it will receive. Then switch to a ⅜-in. brad-point bit (or a spiral bit if your brad-points cut with their outside edges first) and drill a through-hole. Bit the blank aside.

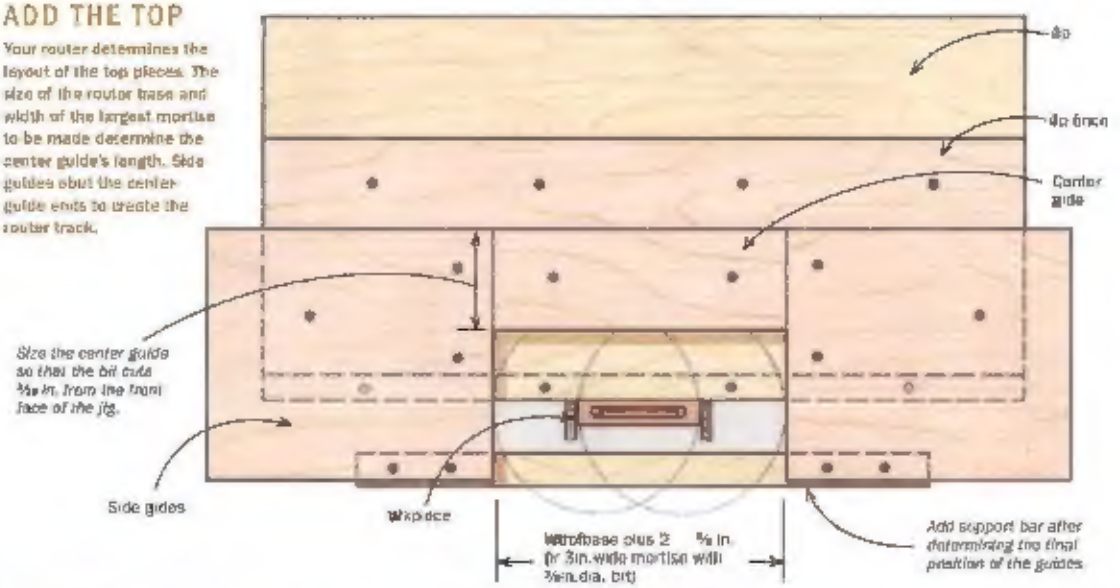
Cut a simple drilling jig from ¾-in. wood or medium-density fiberboard (MDF) long enough to span the drill-press table from left to right. On the jig face, draw two parallel lines perpendicular to the front, separated by the distance between the circle blank's center and an outside bolt hole.

Clamp a fence to the table and place the drilling jig against it. Lining up the left-hand line with the drill bit. Drill a ⅜-in. through-hole on the line. Side the drilling jig to the left and drill a second through-hole on the right-hand line. With the drill bit still in the hole, clamp the drilling jig to the table. Then, raise the bit out of the hole.

Insert a ⅜-in. pivot pin into the left-hand hole, and place the circle blank face-

ADD THE TOP

Your router determines the layout of the top pieces. The size of the router base and width of the largest mortise to be made determine the center guide's length. Side guides abut the center guide ends to create the router track.



Attach the top. *After cutting the top to size, align its front edge with the front of the faceplate and screw it in place (above). Then attach the top fence parallel to the front edge of the top, leaving room for the center guide.*

Clamp the side guides in place and make a test cut. *With a test rail in place, make a cut to determine if the mortise is centered on the workpiece.*

Adjust the side guides until the mortise is centered. *Slide the parts along the top fence to make small adjustments. When the mortise is centered on the rail, screw the parts in place.*

down on the drilling jig with the pivot pin protruding up through the center hole.

Using an accurate combination square, adjust the blank so the jig's sides are perpendicular to the front edge of the platform and drill a ⅜-in. hole for one outside bolt. Then rotate the blank 90° and line it up again with the square. Drill the other bolt hole. The two holes will be equidistant from the center.

Without moving the table or the jig, switch back to the ⅜-in. Forstner bit. Turn the blank over and make the outside bolt counterbores on the back of the blank, squaring up for both. The bits' outside edges will come down centered over the ⅜-in. holes.

Finally, using the center hole as a pivot point, cut a circle out of the blank with a bandsaw or router. Repeat the entire process for the second circle.

Attach the circles to the front plate

Next, make the front plate and draw a vertical line, perpendicular to the top edge, down its center. On that line, mark and drill ⅜-in. holes to receive the center bolts of the circles, allowing the circles to be about 1⅛ in. from the top and centered vertically with their edges ⅛ in. to ¼ in. apart. Make the clamp-access slots on both sides of the front plate (see drawing, facing page), insert

the ¾-in. outer bolts through the circles so that they protrude out the front, their heads nestled fully into the back-side counterbores. Then attach the circles to the front plane with ¾-in. bolts through their center holes. Use flat washers, lock washers, and hand-tightened double nuts to make the circles turn with some resistance. This will enable them to stay tight against the sides of the workpiece and hold it in place for clamping.

To add stability to the jig, I attached front pieces on both sides of the circles. I made them from the circle cutouts so they could be attached to loosely "hug" the diameters.

Test for vertical alignment

Next, make the top faceplate with the half-circle cutout, and screw it in place on the front plane, with both top edges aligned. Square up the end of a 4-in.-wide to 5-in.-wide test rail and place it on the circles with the bolts tight against the sides. Adjust the test rail vertically so its top edge is even with the top of the faceplate and front plate. If they don't align evenly along the entire top edges of the rail, mark and trim the top edge of the faceplate/front plane until they do. Make sure this edge is square in the front-to-back plane as well.

Test the centering

Make the top and use 1½-in. drywall screws to attach it flush with the front. Make the top fence and clamp it to the top, parallel to the front edge. Next, make the center guide against which the plunge router will track. It should be precisely as long as needed to rout the longest mortise you intend to make. And it should be precisely as wide as needed to align the router bit over the center of the thinnest rail to be mortised. My jig is set to cut a centered ¾-in. mortise in a ¾-in. board.

Place the center guide against the front of the top fence. Center it left-to-right over the circles' vertical axis, parallel to the top's front edge.

Next, make the side guides and clamp them to the top, abutting the center guide on both sides.

Retract and clamp the test rail in the closed circles flush with the top. Cut shallow test mortises and keep adjusting the center and side guides until both shoulders are exactly equal. Then screw the guides in place.

Using the jig

1 MORTISE THE END PIECE FIRST

Start by aligning the workpiece securely inside the bolts and clamping it in place. Then with the router firmly against the center guide, start the first cut by plunging approximately ¼ in. as you move the router left to right. Repeat the process in increments until the desired mortise depth is reached.

2 ATTACH A STOP BLOCK AND MORTISE THE MATING PIECE

For the matching side mortise, leave the first workpiece in place and clamp a stop block firmly against one of its sides (above). Then align the mating piece by butting it against the stop block (right). Clamp it in place. Now rout the mating mortise.

Vary mortise size and location with spacers

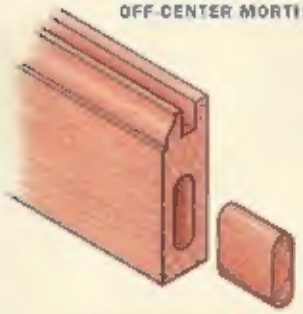
SIDE SPACERS FOR NARROW MORTISES

Lehman taped ¼-in. spacers inside the side guides to switch mortise lengths from 3 in. to 2 in., the two sizes he needed. Size the spacers to match your own needs.

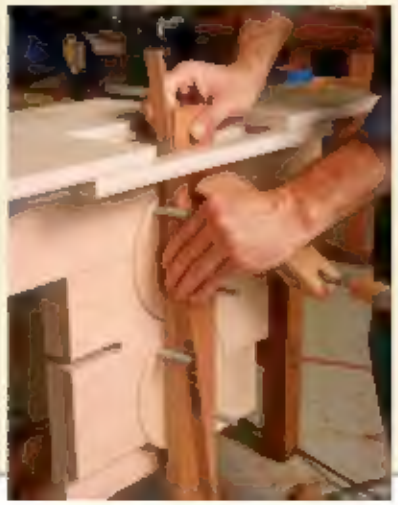
BACK SPACER FOR THICK OR OFFSET PIECES

A thin spacer taped to the front of the center guide gives you several options. You can center a mortise in a thicker workpiece, or make an off-center mortise (for example, as needed for a table apron-to-leg joint.)

WORKPIECE SPACER FOR OFF-CENTER MORTISES



Attaching spacers to one side of a workpiece sets up for an off-center mortise.



Finally, install a support bar under the front edges of the guides, spanning the gap between them. This will provide a front base to keep your router from tipping.

Use the right router and bit

This jig is designed for a plunge router. I use a 3-hp DeWalt with a flat edge on its base that I run along the back fence. If you use a router with a fully circular base, keep the same point against the fence throughout the cut (circular bases aren't always circular or concentric with the bit).

You can use either a straight bit or an up-spiral bit, which will pull the chips out of the mortise. I hook up my router's dust collector for extra chip-clearing.

Do the bulk of the cutting from left to right, so the cutting force keeps the router pressed against the fence. Most router bits won't cut at their very center, so plunge down in ¼-in. increments on each left-to-right stroke, returning to the left without plunging.

Mortises can be centered or off-center

Centered mortises are made by clamping the rail in the circle guides and plunge routing to the desired depth. Make sure to center-mortise workpieces consistently, front and back.

For a face frame, mill the mortise in the rail end first. With the rail still in the jig, clamp an end stop in place on either side of the rail. Remove the rail from the jig and clamp the stile against the stop and flush to the bottom of the wings. Then mortise the stile.

To make off-center rail-end mortises or to change their length, place appropriately sized shims inside either or both side guides. The same shims are inserted alongside the stop blocks when mortising the matching stiles. A shim inside the center guide sets up for thicker or offset workpieces. I use masking tape to hold the shims in place.

Once the mortises are made, you've come to the final step—making the loose tenons. Cut long pieces of wood slightly thicker than your mortises will accept. Round over their edges, and plane them down to fit snugly into the mortises. Finally, cut them to length.

David Lehman is an orthodontist and part-time woodworker in Elkhart, Ind.